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MassGIS Standard for Digital Parcel Files and Related Data Sets

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PREFACE TO VERSION 1.5

Version 1.5 of the standard is being released after two years of experience within various organizations that have worked with version 1.0 of the standard. From feedback provided by people in these organizations, the standard has worked well. Version 1.5 includes two fundamental changes, a re-organization, corrections to minor errors, some additional definitions, expansion and re-writes of some sections, and a new Appendix describing MassGIS QA checks. There are two key changes in this version of the standard. First is that the "INTEREST" and POLY_TYPE" parcel attributes are no longer part of the Level I requirements. Second is the requirement for breaking the parcel address into separate database fields has been changed so that it is not required until Level III, where it is incorporated into the required master address file. The re-organization changes where the discussions of recommended versus required elements are presented. In addition, the discussion of the various attributes has been re-arranged and those changes are reflected in Appendix A. There have also been some small changes that should make the document easier to use, notably the addition of page references in Table 1. Finally, the intersection and assessing data tables may now be delivered in a Microsoft Access database. **While Appendix B describes the changes in detail, it is not a substitute for a careful reading of this new version of the standard.**

Caveat**:** *This standard for spatial accuracy and detail of property boundaries and related attribute information is for developing digital versions of assessor's property maps for use in planning, property assessment, and graphic map display. There is no intent to provide a standard for developing the authoritative definition of property boundaries or to specify limits for legal boundary determination or property conveyance purposes. Matters related to those more definitive interests remain the purview of the professional title attorney and/or professional land surveyor.* (Based on text obtained from Rhode Island GIS)

The standard is now being widely used. The digital parcel files being created for 34 cities and towns as a result of the MassGIS digital parcel grant program inaugurated in 2002 were required to conform to Level II of the standard. Future rounds of the grant program will provide funding for compliance with Level I of the standard, although the highest state funding level will be for compliance with Level II of the standard. Many communities have independently chosen to use the standard at Level I and II. One or two communities are even evaluating implementing Level III of the standard.

Interest in a statewide digital parcel data layer is growing. Here at MassGIS, we remain committed to developing this very important GIS data layer. One key to achieving that objective is widespread implementation of this standard. We look forward to working with the many organizations, public and private, that will be involved in this effort. If you have questions about the standard, corrections, or suggestions for improvements, please forward them to one of the individuals below.

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A copy of this standard may be obtained from the MassGIS web site at:
http://www.state.ma.us/mgis/muniparc.htm.

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INTRODUCTION

Planning for economic development, growth management and environmental resource protection, delivering local and state government services, providing public safety and emergency response and mitigation, managing transportation infrastructure and many other government functions require information about property boundaries. Often these activities involve regions covering part or all of many towns. Property boundaries, and sometimes other legal interests in land, are depicted on assessor's property maps. These standards apply to mapping by municipalities of the boundaries of legal interests in land as depicted on assessor's maps. Besides fee ownership, these legal interests typically include public and private rights of way and easements. They may also include special taxing districts and other legal interests or areas with special assessment status (e.g., conservation restriction or agricultural preservation). For simplicity, all boundaries on a community's assessor's property maps are referred to in this standard as "property boundaries".

Increasingly, assessor's maps are maintained in digital form. There are numerous benefits associated with having standards for the format, quality and documentation of this mapping and associated data files. For digital parcel boundary files from multiple communities to be used together, they must all be developed according to the same digital file standard or at a minimum have common, well-defined and compatible data elements. Without such standards, making digital files from multiple communities compatible requires a prohibitive amount of work. Standardization makes it much easier and more efficient to use these files and to develop end-user applications with them. Standards for quality and for documentation provide assurance that the files can be used appropriately and in particular that information from different sources can be combined, e.g. information on hazardous waste sites, property boundaries and public water supplies can be shown in a common geographic reference and correctly interpreted.

Complying with this standard requires that each legal interest depicted in the digital parcel file or files must have its own map polygon, which may overlap or be coincident with other polygons. Representing each legal interest shown on the assessor's maps with polygons makes it possible to distinguish legal interests depicted on the assessor's maps using different line symbols or area shadings. Whether these different polygons are stored in separate GIS data layer files or in a single file or, as is possible with recent GIS technology developments, in a single "relational" database, is a decision made by the digital parcel file's custodian. If the polygons representing different legal interests are stored together in a single file or database, the type of legal interest represented by each polygon must be differentiated in the database. The mechanism for this differentiation is presented later in this standard.

PURPOSE

This standard has five purposes:

1. Providing communities a flexible specification for developing a digital parcel file suitable for use in a geographic information system (GIS). Because text labeling and the creation of a master address file are integral to extending the usefulness of a digital parcel file, portions of this standard address the creation of those datasets.
2. Making it possible to merge digital property information from more than one community for multi-town mapping and spatial analysis.
3. Being able to identify a single property parcel statewide based on a single unique identifier.
4. Assuring a minimum level of spatial accuracy.
5. Assuring a minimum and consistent set of attributes

This standard is NOT a general purpose standard for traditional printed parcel map sheets.

AUTHORITY

As the Commonwealth's Office of Geographic and Environmental Information, MassGIS has the legislatively assigned authority and mandate to "set standards for the acquisition and management of geographical and environmental data by any agency, authority or other political subdivision of the Commonwealth"(Ch. 21A, 4B, MGL). **Compliance with Level I of this standard should be the minimum required by any community that contracts for or otherwise arranges creation of a digital version of their assessor's maps or their equivalent.** This requirement will not usually be burdensome for most communities, as digital parcel files developed by those experienced in the issues of GIS data and application development would comply with most, if not all, of the Level I requirements as a matter of good professional practice.

NOTE: Assessor's parcel maps are for tax assessment purposes and, unlike areas outside New England, are not the legal (cadastral) record of property ownership. In Massachusetts, the legal record of property ownership is found at the deed registration offices. While property boundaries on assessor's maps often serve as a proxy for ownership, any authoritative representation of property ownership must be based on records from the registry of deeds and/or work by a licensed professional surveyor.

THE STANDARD DEVELOPMENT PROCESS

This standard was drafted by MassGIS staff, drawing upon their experience with parcel map conversion and with developing GIS applications in municipal government. Standards from other states, notably Vermont and Wisconsin, were also reviewed. GIS consultants active in parcel map conversion in Massachusetts reviewed and commented on an early draft. Subsequently, GIS consultants, GIS staff at Massachusetts' regional planning commissions, individuals with substantial experience working with municipal property valuation data and functions, and municipal GIS staff reviewed and commented on a subsequent more advanced draft. Many helpful comments and suggestions were received; many of them resulted in changes to the standard. Appendix B lists the changes made in Version 1.5.

OVERVIEW

This standard is being issued in three parts or levels. Level I is an approach to digital parcel mapping that should be useful to any entity or individual in the Commonwealth involved in conversion of maps to digital form or maintenance of digital parcel mapping as part of a GIS database. It incorporates commonly accepted, reasonable approaches to developing digital parcel boundaries. Level I covers digital property boundary compilation and the minimal descriptive or attribute information needed to support common municipal GIS needs; it also includes some recommended practices that, when implemented, would make the digital parcel information more useful, both to the municipality and to other organizations.

Level II applies to any state or regional public entity that has committed resources or staff to developing parcel data, and by extension to any business or other entity that is receiving state funding for providing digital parcel information. Additional attributes are required at Level II and there is a requirement for creating a parcel ID that is unique statewide. In addition, an enhanced link to assessing data must be created using an "intersection table". At Level II there is also a requirement for using the official legislated town boundary, the NAD 1983, and for creating metadata.

The enhanced link to the assessing data means that every taxable or tax-exempt property represented on the assessor's maps must be linked to a record in the assessor's property database. Conversely, every record in the assessor's database must be linked to a property represented on the assessor's maps. One result of this requirement is that the assessor's property database becomes an inventory of land in that city or town instead of simply an inventory of properties that receive a property tax bill.

Level III covers making the link between the assessor's database and the GIS more direct and developing a master address file.

Regardless of the level at which this standard is implemented, the implicit assumption is that in a city or town it will most likely be implemented by one of the following:

1. Professional GIS staff employed by a city or town.
2. Other non-municipal organizations (e.g., regional planning agencies) who undertake the conversion or maintenance of the assessor's maps under contract.
3. Consultants

Note that property boundaries compiled in accordance with Level II or III of these standards and delivered to MassGIS may, after written notification by MassGIS, be printed or distributed with the statement: *"Property boundary automation approved by MassGIS in <year> as conforming to Level II / III of the MassGIS Digital Parcel Mapping Standard"*.

Table I on the next page summarizes the required and recommended elements at each level of the standard.

TABLE 1: Required and recommended elements of the standard at each level

ELEMENT IN STANDARD	STANDARD		
	LEVEL I	LEVEL II	LEVEL III
Parcel Boundary Compilation (P. 11)	REQ	REQ	REQ
Required Parcel File Attributes (P. 14, 19)	REQ	REQ	REQ
Assessor's Records Attributes (P.14)	REQ	REQ	REQ
Horizontal Datum (NAD83) (P. 16)	REQ	REQ	REQ
Metadata (P. 16)	REQ	REQ	REQ
Street Network Datalayer (P. 17)	rec	rec	rec
Text Labels (2) (P. 18)	rec	rec	rec
Intersection Table (P. 21)	N/A	REQ	N/A
Town Boundary (1) (P.23)	rec	REQ	REQ
File Format (P. 24)	rec	REQ	REQ
Recommended LOC_ID Archive (P. 24)	rec	rec	rec
Integrate Loc_ID into Assessor's Database (P. 26)	N/A	rec	REQ
Master Address File (P. 26)	N/A	rec	REQ
Unique Building Identifier (P. 28)	N/A	N/A	rec
Deliver Data Files to MassGIS	rec	REQ (3)	REQ(3)

REQ = Required; rec = Recommended

(1) When required, this is subject to appeal (see pp. 23 - 24)

(2) For example, features created to make it possible to label property boundaries with their dimensions.

(3) Desirable but optional if no state funding involved.

DEFINITIONS

The following definitions will help in understanding this standard:

Assessor's database – This is the database of property assessment information maintained by the assessor; it is also referred to as the tax list, property list, CAMA system, CAMA database, appraisal database etc.

Attribute – A single element of non-graphic (e.g., name of owner, property area, property value) information stored in a database field and usually, in the context of this standard, associated with a single geographic feature (e.g. a property parcel on a map).

Base Map – This refers to a map portraying basic reference features on the earth's surface (both natural and cultural) onto which other, specialized, features (e.g., property boundaries, water mains) are placed. Common examples are the MassGIS/Masshighway color orthophotos and the U.S. Geological Survey topographic maps.

Build_ID – The Build_ID is a unique identifier used only in Level III of the standard. This identifier is created in the same manner as that for the Loc_ID (see below). Each polygon representing the outline of a building would contain this idenfier.

Digital Parcel File – This refers to a computer file or files containing a graphic (vector) representation of the boundary information originally depicted and maintained on a city or town assessor's maps. Besides fee ownership, boundaries that may appear in this file or files include public and private rights of way and various different kinds of easements. These files are typically created in and maintained using GIS or computer assisted design (CAD) software.

Interest – This is a database field that must be created for compliance with Levels II and III of this standard. It must appear as an attribute of the parcel file. This attribute is used to identify the "ownership interest" in each polygon in the digital parcel file. There are many types of ownerships rights in land. These include owning all the rights ("fee simple" ownership) or some of the rights (e.g. development rights, air rights, various easements). While the predominant type of ownership shown on assessor's maps is fee simple ownership, they also show rights-of-ways, easements, condominiums, and other "rights in land". Valid entries in this field are "FEE" (fee simple interest, indicating that the owner probably possesses all the legal rights of ownership, although that can only known completely by checking a specific property at the registry of deeds), "PUB ROW" (publically owned right-of-way, including state and federal highways), "PRIV ROW" (privately owned right-of-way), "RAIL ROW" (rail road right-of-way), "EASE" (easement), "CONDO" (condominiums), "CR" (conservation restriction), and "APR" (agricultural preservation restriction). Each of these entries provides an explanation for the ownership interest of polygons that may appear on assessor's parcel maps or other records of land rights. Note that some of these interests may be partial or overlapping. So, for example, a conservation or agricultural restriction may apply to only part of a property or parts of multiple properties. For either of these restrictions, an assessor's map or other record of land rights (e.g., state mapping of conservation restrictions) might show a separate polygon boundary overlaying the other polygons indicating deeded ownership, to identify the area subject to the restriction. **In developing parcel files complying with this standard, only the polygons that appear on the assessor's maps need classification through this field. So, for example, if there are no conservation restrictions mapped on the assessor's maps, then no INTEREST values of "CR" will exist.** A full database definition of this field is in Appendix A.

Intersection Table – This separate database table is created in complying with Level II of this standard. It includes two fields: the Prop_ID and the Loc_ID. These fields are defined below. The intersection table provides a mechanism for correctly associating multiple assessing records (e.g., those for condominiums) with a single map parcel polygon and vice versa. Whenever a row is added to the intersection table, BOTH the Prop_ID AND the Loc_ID must be filled.

Loc_ID – This identifier is specific to this standard. It appears in two places, once as an attribute of the parcel file and once in the intersection table. The Loc_ID is a unique identifier for parcels created from database fields containing the X and Y coordinate values (Massachusetts State Plane System, NAD83 datum, in U.S. Survey Feet OR meters, depending on the coordinate system used for the rest of the parcel file) of a point that lies within the polygon. This point is preferably at the polygon's visual center. One way to create the content for this field is to add database fields to the digital parcel file, one each for the "X" and "Y" coordinate values. The X and Y coordinate values can then be appended together, separated by a single underscore character ("_"), into a field called Loc_ID; numbers in these coordinate values after the decimal place must be dropped. This identifier has two useful properties. First, it is unique (it is a database primary key) statewide. Second, because it is derived from coordinates, it can be used by GIS software to locate the parcel in the absence of any other identifier. Furthermore, these coordinate values can be readily added to database fields for every map parcel using standard capabilities in most software used for spatial data development.

Loc_ID_Un = This field identifies the units of the coordinates from which the Loc_ID is built. Valid values are "F" (feet) and "M" (meters).

Map_Par_ID – This is a parcel identifier whose purpose is to unambiguously reference one or more polygons on the map. While the name of this database field is unique to this standard, a field containing the same information must exist in any digital parcel file if that file is to be linked, however imperfectly, with information from an assessor's database. In digital parcel attribute files, the content of this field is usually created by "merging together" various identifiers, (e.g., map number/map sub-number/parcel number/parcel sub-number, or map/block/lot or section/block/lot, that appear on assessor's maps. The various components of this identifier will vary from community to community.

Typically each parcel polygon on an assessor's map is labeled with the lot number. The map number may only appear once on the map sheet, and, if used, the block numbers may appear as needed to differentiate the different blocks on the map sheet. As discussed under Level II of this standard, while this identifier uniquely identifies one ownership interest, it may not be a unique identifier on the assessor's maps. The key requirement for the Map_Par_ID is that it corresponds to a parcel identifier shown on the assessor's map.

Two situations may arise in the context of the Map_Par_ID. In the first, a town or city already has a unique identifier that serves the purpose of linking the assessor's data to an identifier associated with parcel polygons on the map. If this is the case, then that identifier should be used as the Map_Par_ID. In the second situation, this identifier does not exist. In this situation it is constructed as described above from various component fields to achieve compliance with this standard. When this occurs, the component parts (e.g., map, block, lot or map, lot, etc) **must be separated by an underscore character ("_")**. In either situation, the field being used as a unique identifier must be named MAP_PAR_ID. If the existing equivalent identifier has a different name, it can be re-named, an alias field name can be assigned, or information in the existing field can be copied into a field with this name. So, for **example**, the parcel on a hypothetical map 14, block 6, lot 12 would be identified by in the Map_Par_ID attribute in the digital parcel file as 14_06_012.

Parcel – In this standard, this word refers to the polygon representing the boundaries of some "rights in land" (e.g., fee simple ownership, easement, private right-of-way, etc.) on a city or town assessor's maps.

Poly_type - This is a database field that must be created for compliance with Levels II and III of this standard. It is used to identify polygons on the parcel map that are not created to indicate ownership rights but to identify some other feature of interest. Valid entries in this field are "TRAFFIC ISLE", "WATER", "ISLE", and "OTHER". The value "TRAFFIC ISLE" is used to identify raised areas in road rights-of-way that are mapped as separate polygons to more accurately depict the road; the other entries are self-explanatory.

Property – In this standard, this word refers to a record in an assessor's database.

Prop_ID – This database field contains the information needed to uniquely identify a single property in the assessor's database. In other words, each Prop_ID must be unique. The Prop_ID field is created in conforming to Level II of this standard and must exist in a database table containing the assessing information required at Level II; it must also exist in the intersection table. Unless there is no relationship between the way the assessor identifies records in their database, and the way properties are identified on the assessor's maps, the Prop_ID must be constructed in a manner similar to the MAP_PAR_ID. That is to say, it is made up of the same component parts (e.g., map/block/lot, etc) merged together. When these components are merged, with an underscore ("_") separating the component parts, they create a unique identifier for each record in the assessor's database. Sometimes this unique identifier may already exist in a single field in an assessor's database. More often its component parts (map/block/lot, section/block/lot, etc.) are stored in separate fields in an assessor's database. As with the MAP_PAR_ID, when the information in these fields is merged together, it yields a unique identifier.

For some assessor's records, the Prop_ID may not be exactly the same as the MAP_PAR_ID, because not every property record in an assessor's database necessarily matches a parcel on a map. Condominiums are the most common example. Each condominium is a record in the assessor's database because each condominium owner needs to receive a property tax bill. However, condominiums cannot be uniquely identified with the same information used to identify other properties (e.g., map/block/lot, etc.). This is true because two or more condominiums appear on one lot and they cannot each have the same lot number. This situation is commonly resolved by extending the lot number so that it becomes unique for each condominium. So for example the condominiums on "lot 1" have lot numbers 1A, 1B, 1C, etc. Other mechanisms exist for identifying condominium records in assessment databases. The key requirement for the Prop_ID is that it uniquely identifies each property record.

Registration - In this document, registration refers to the process of finding reference points on a map/image document and assigning them coordinates from their known positions in the real world. Once coordinates are specified for enough points on the map/image document, the entire digital document may be mathematically transformed to real-world coordinates for GIS display and analysis.

Scan - This refers to the process of making a digital image of a document (e.g., a map, text document, or photo). A scanned document can be displayed on a computer screen, but until locations on the document are assigned ("registered") to map coordinates, it cannot be overlaid with map features in a GIS database.

DIGITAL PARCEL FILE STANDARD LEVEL I

This level of the standard includes required and recommended elements. They are presented below in that order. Compliance with the required elements of Level I should be the minimum acceptable standard for developing a digital parcel file. Level I compliance requires digitizing assessor's maps in accordance with the boundary compilation requirements described below, assigning an identifier (the Map_Par_ID) to each parcel polygon, and then joining the resulting map information to information extracted from the assessor's database.

In situations where funding is limited, creating a digital version of the assessor's maps may have to be limited to converting parcel boundaries on the existing maps to digital form. This approach might or might not include assigning an identifier (Map_Par_ID) to each parcel polygon. If no Map_Par_ID is assigned, it will not be possible to link the digital parcel file to information from the assessor's database. While this cannot be considered "compliance" with level I of this standard, it is certainly a worthwhile start. Such a product can still be used to demonstrate some of the values of the digital file and, perhaps through a pilot project for a small area, of the value of linking the parcel polygons to assessing information. Subsequent funding might then be used to complete assigning the property identifier (Map_Par_ID), thus creating the capability to join the parcel polygons with information downloaded from the assessing database.

REQUIRED ELEMENTS

The following summarizes the required elements for digital parcel files at this level:

1. Parcel Boundary Compilation – The digital parcel file must conform to minimum compilation standards and horizontal accuracy requirements for property boundary locations.
2. Parcel File Attributes - The attributes of the parcel polygons must include an identifier, the Map_Par_ID, for each polygon that should link to an assessor's record.
3. Assessor's Records Attributes - The attributes of the parcels must include a minimum set of attributes (see Appendix A) extracted from the assessor's database. In addition, the attribute field called Prop_ID must be added to this copy of the assessing data.
4. Horizontal Datum – The digital parcel file must use the North American Datum of 1983 (NAD83) or a successor and the state plane coordinates system.
5. Metadata.- This file provides information needed to better understand the digital parcel file.

Note that at this level of the standard, the file format for the digital version of the parcel maps shall be in the software format specified by the recipient. Both the required and recommended portions of this level of the standard are presented in more detail below.

1. Parcel Boundary Compilation

Background

Assessor's maps are converted to a form useable in a GIS using one of three approaches:

a) Individual maps are scanned, registered to a geographic coordinate system, and then lines from the maps are converted to digital form, usually by "heads up" digitizing on a computer screen.
b) Individual maps are registered to a geographic coordinate system on a digitizing table and the lines are digitized.

c) Deeds for each property are examined, and the property boundaries are re-constructed and pieced together along with those of adjacent properties based on the coordinate geometry of the boundary distances and bearings. This too results in a digital file. This method costs the most, but provides the highest accuracy result.

Sometimes a combination of the above methods may be required.

Requirements

Digital parcel boundary compilation MUST result in a single GIS data layer or file containing a seamless depiction of a community's property boundaries. The digital file must also be as faithful as possible to the original map sources. This file must represent the best professional judgment of the organization performing the conversion about how to reconcile discrepancies between different map sheets so that all properties are represented, no property "slivers" or gaps occur, boundaries have no gaps where they previously crossed a map sheet edge, and all polygons are closed. In some instances, it may not be possible to resolve discrepancies or errors without deed research. Whether or not deed research is part of developing a digital parcel file would be up to the community involved. Note that compliance with Level II of the standard may require at least some deed-based resolution.

Regardless of the compilation method used, property boundaries will be registered and/or adjusted to match apparent features on the base map. How much the property boundary locations are adjusted to "fit" the base map will depend on the compilation method, with more adjustment occurring when digitizing boundaries from the assessor's maps and less adjustment occurring when the property boundaries are based on deed research. The base map must be the 1:5000 scale MassGIS/MassHighway color orthophotos (approximately 1 in. = 400 ft.) OR some other at least as accurate orthophoto or planimetric base map. Detailed information about the MassGIS/MassHighway orthophotos can be found on the MassGIS web site at http://www.state.ma.us/mgis/colororthos2001.htm.

If the compilation involves registering the property boundaries to an orthophoto base, the registration should be accomplished by matching visible features on the map to corresponding features on the orthophoto base. Roads, structures, and water bodies will be the most common such features. The minimal standards for geographic registration to and compilation on the base map are:

a. Coincidence with Base Map Features
b. Minimum Horizontal Accuracy Requirement
c. Coincidence with Street Rights-of-Way
d. Respect for Subdivision Accuracy
e. Continuous Lines and Closed Polygons
f. Continuous Lines Across Map Sheets

Each of these is discussed below:

a. Coincidence with Base Map Features - Property boundaries are often coincident with clearly defined and visible features on the base map. These include features such as the "back-of-the-sidewalk", stone walls, hedges and tree lines, etc. Therefore, within the limits of the orthophoto base map's absolute accuracy and other constraints (such as what can reasonably be interpreted from the orthophoto imagery), and when appropriate as determined by the map compiler, parcel boundaries should be registered as accurately as possible to features visible on the base map. When using the MassGIS /MassHighway

orthophotos as a compilation base, such features should not be displaced in excess of three (3) meters relative to corresponding features on the base map. Note that legal parcel boundaries may or may not be coincident with visible features, and that some features (e.g. the coastline, river banks, and pond/lake edges) can move over time. Therefore, assumptions about coincidence with visible features must be carefully reviewed, case-by-case.

b. Minimum Horizontal Accuracy Requirement - Vector features from a road centerline GIS or CAD data set which meets National Map Accuracy Standards at 1" = 400', or better, shall lie completely within the rights of way shown on the parcel map. The 1:5000 scale roads shapefiles presently available through MassGIS would be the default choice for this verification; by 2004 or before, it is expected that this 1:5000 scale road data will be in use by MassHighway and therefore MassHighway road data would be equivalent. An exception to this requirement would be if in the judgment of the organization performing the original conversion or reviewing such conversion the street was NOT in fact built within the right of way. Also, there may be "paper streets" or newly constructed roads for which no representation exists in a road centerline file.

c. Coincidence with Street Rights-of-Way - As a general rule, the street rights-of-way depicted on the assessor's maps should be compiled so that they coincide with the apparent "back-of-the-sidewalk" on the orthophoto base map. If in locating the boundaries of the public street right of way there is an inconsistency between following visible "back of sidewalk" features and maintaining a correct and consistent width of the right of way, priority should be given to showing a correct and consistent width; the exception to this is highway rights-of-way, which often have irregular widths or have much greater distances between the edge of the pavement and the actual edge of the right-of-way. If the MassGIS/MassHighway orthophotos do not show recent subdivisions, then they will not provide information needed to guide the boundary compilation. This situation can be remedied if state plane or some other coordinate system can be introduced into or exists in a CAD file of the subdivision. Parcel boundary junctions in common between the subdivided parcel(s) and the subdivision may also provide control points for the update. In the absence of any information, the best possible approximation of the boundaries should be created.

d. Respect for Subdivision Accuracy - Where subdivision information of known survey level accuracy has been submitted to a city/town in digital form and is being incorporated into a GIS or CAD data set, the compilation procedure should respect the accuracy of those boundaries relative to the rest of the map. Subdivisions can be moved, rotated, or adjusted in their entirety, but subdivision boundary arcs should not be adjusted relative to adjacent boundaries unless the adjacent boundaries are known to be of comparable accuracy. When boundaries of adjacent subdivisions do not coincide within the limits of the horizontal accuracy of the map, then further research is needed or the boundary needs to be mapped so the ambiguity is apparent. When the boundaries of adjacent properties are less accurate than the sub-division, they should be adjusted to fit those from the sub-division. An exception to this requirement should only be made if there is an error in the subdivision map or if boundaries shared with adjacent parcels are known to be more accurate than those depicted on the subdivision map. See the "source" attribute in the discussion of optional parcel file attributes, below

e. Continuous Lines and Closed Polygons - Lines must be geometrically continuous and boundaries must be geometrically closed with no "undershoots" or "dangles" where

boundaries intersect. The conversion process must not create "sliver polygons" (gaps or overlaps between properties) not on the assessor's maps. Polygons representing small ponds, traffic islands, or other miscellaneous areas that are not property parcels, must be correctly identified in the POLY_TYPE attribute (see discussion below).

f. Continuous Lines Across Map Sheets - No bends or other deformities in the boundary lines corresponding to seams in the original map sheet layout should be visible.

2. Parcel File Attributes

Compliance with Level I of the standard makes it possible to view selected information from the assessor's database when viewing or requesting information about the digital parcel file; this capability is essential for many local government uses of GIS and depends on a required parcel attributed.

Required Parcel File Attribute

MAP_PAR_ID – This attribute is the property ID that appears on the assessor's map (see page 9 for full explanation)

Optional Parcel File Attributes

Optional parcel file attributes, which, if used, should come after the required attributes listed above, might include:

1. ZONING = Zoning classification, if available in Assessor's database (character field)
2. MAP_NO = Map number of the assessor's map sheet from which the mapping of the parcel in the digital file was created (character field).
3. SOURCE = Boundary feature source (character field; valid values are ASSESS MAP, SUBDIV, SUBDIV ANR, ROAD PLAN, OTHER).
4. PLAN_ID = Identifying information for plan (e.g, subdivision or road plan) used to update the digital file (character field).
5. UPD_DATE = The date of update to the the property boundary. Should include the year and month of the update (character field, size 6, entries formatted as YYYYMM).
6. RES_AREA = Total residential living area in square feet (not gross building area) as defined by the assessor (e.g., this may or may not include only heated space). This is a useful attribute when evaluating development proposals relative to surrounding residences, but a difficult one to create because it may require adding areas from multiple fields in the assessor's database (numeric field).
7. CI_AREA = Gross building area for commercial/industrial properties in square feet. This is a very useful attribute for evaluating proposed and existing development, but it is difficult to create because it may require adding areas from multiple fields in the assessor's database (numeric field).

3. Assessor's Records Attributes

Accessing attributes from the assessor's database throught the parcel file is usually accomplished by obtaining a copy of the necessary assessor's information (e.g., as a comma delimited ASCII or Excel spreadsheet file), importing it to a database table in the GIS software, and joining it to the digital parcel map based on a common identifier as discussed below. As part of this process the field names in the database containing the copy of the assessor's information are defined ahead of time. (See definitions in Appendix A.)

Initially joining information from the assessor's database (in digital form) to the digital parcel file involves joining information in a database field common to both. **This generally requires adding or using an existing identifier for the individual property records extracted from the assessors database whose content will match that of the MAP_PAR_ID created as an attribute for each digital parcel during, or subsequent to, the parcel compilation process.** Note that it may not be possible, without quite a bit of additional research and data clean up, to make this join between the assessor's list and the digital parcel map for every single parcel or property record. This level of the standard requires only an initial good-faith effort to join attribute information as completely as possible using the MAP_PAR_ID in the parcel attributes and the PROP_ID created in the extract from the assessor's database. For compliance with this Level I requirement, a sizeable majority of the map polygons must join to the appropriate assessing record. Level II of this standard provides a mechanism for improving the match percentage. Note that a property record identifier being used in the assessor's database to link to the parcel mapping may or may not satisfy the uniqueness definition of the Prop_ID as defined above. This situation is also dealt with under Level II. On the other hand, if the assessors database has been set up so that there is a single property record for each parcel on the map (the ideal situation), then it will be much easier to adapt it to the linking mechanism described above. For this situation to exist, assessor records for condominiums would need to be stored separately or otherwise segregated and linked to the appropriate land record.

The list of required attributes from the assessor's database is below; it includes information commonly needed for GIS applications involving parcel data, both at a town and a regional level. Attribute names are required to match those listed below and the definitions in Appendix A. Attribute names and definitions must agree if data from multiple towns are to be used together The ability to use data from adjacent communities is relevant not only for multi-town digital parcel files but also to individual towns. For example, parcel data from adjacent communities is needed to support abutter notification mailings, "comparables" for property assessments, mapping locations of students when schools are regional, reviewing proposed developments that straddle town boundaries, and police/fire tasks such as crime mapping, mutual aid dispatch support, and lost-person searches.

Because these required attributes names can be established ahead of time, typically as a digital parcel file is developed, these attributes and their names pose little or no difficulty for a community that is developing a digital parcel file. Where a town or city has already established different attribute field names for these same attributes, these required field names would make complying with the standard difficult. Communities in these circumstances have three options: rename attributes, add alias field names, or maintain two fields with the same information.

The minimum set of attributes linked to the digital parcel file (i.e., in the polygon attribute table or shape table) from the assessor's database consists of the following (complete field definitions are in Appendix A). Note that information may not be available to populate some of these, but must be included if it is available, which distinguishes them from the optional fields listed after.

1. PROP_ID = Unlike the items below, this attribute does not come directly from the assessor's database. Instead it is constructed from information typically found in multiple columns in the assessor's database (see definition for more information). It must be unique.
2. TOTAL_VAL = Current total assessed value for land and structures (numeric field). (NOTE: DOR does not require values to be split up any more and the trend is to have only a Total Assessed Value.)
3. FY = Fiscal year of assessed value (character field)

4. LOT_SIZE = Deed area in EITHER square feet OR acres, but not both (numeric field, allowing for up to two decimal places)
5. LOT_UNITS = Deed area units (character field; valid values are "S" for square feet and "A" for acres)
6. LS_DATE = Last sale date (character field, not data field because dates come in too many variations but are easy to place into a character field)
7. LS_PRICE = Last sale price (numeric field)
8. LAND_USE = State use code (numeric field)
9. LO_NUM = The lowest house number associated wih a parcel; for a single family home, this is the only house number associated with the parcel.
10. HI_NUM = The highest house number associated with a parcel when the parcel contains a multi-family dwelling with separately numbered doors. For single family homes this field would be blank.
11. SITE_ADDR = the property's address (defined as some or all of the following: street name portion of an address cardinal directions, street name, and street suffix; for example, South Main St)
12. SITE_CITY = city or town where the property is located
13. SITE_ZIP = zip code where the property is located
14. OWNER1 = Name of first owner of record (character field)
15. Owner address in the following fields: street address (OWN_ADDR), city (OWN_CITY), state (OWN_STATE), zip/mail code (OWN_ZIP), and country (OWN_CO).
16. LS_BOOK = Last sale Registry of Deeds book (character field)
17. LS_PAGE = Last sale Registry of Deeds page (character field)
18. LIV_UNITS = Number of living/dwelling units (apartments and condominiums, if available in assessor's database; numeric field; if not available, leave blank)
19. BLD_AREA = Building area (square feet) for commercial/industrial properties as defined by the state use codes. (only required if information available from assessor's database; numeric field; if not available, leave blank).

Note that the above are required for this standard, but nothing precludes a community from including additional information from the assessor's database as needed for GIS use. These additional items of information would, in effect, be additional "optional" attributes.

4. Horizontal Datum

While many communities have their own horizontal survey datum, complying with this standard requires using the North American Datum of 1983, or a successor. This will facilitate using digital data from other sources (e.g., MassGIS and the regional planning agencies) and from adjacent communities. Likewise, the community must use the State Plane Coordinate reference grid with units of US Survey feet or of meters. Note that Nantucket, Martha's Vineyard, and the Elizabeth Islands have their own state plane coordinate system zone, the Island Zone. Digital parcel files developed for those areas will likely need to be developed in Island Zone.

5. Metadata

GIS data being created by or for a community are records that will exist long after those involved in creating them are gone. Therefore, metadata is essential. A GIS data development project should not be considered complete until metadata (data describing the GIS data) are also completed. This information is needed to properly understand and use any GIS data layer, now and in the future. This is particularly true with digital data because they are much easier to disseminate than the original paper or mylar maps.

Creating complete metadata should be part of creating GIS data and is good professional practice. MassGIS requires that metadata complying with the Federal Geographic Data Committee's metadata standard be required from any organization that delivers or creates digital GIS data. For more information about metadata and links to web sites that provide metadata tools see the following location on the MassGIS web site: http://www.state.ma.us/mgis/munimeta.htm. The metadata should include the name and version of the CAMA software from which the parcel attributes were drawn and the file format of the extract from the assessor's database.

RECOMMENDED ELEMENTS

The following are recommended elements at this level of the standard:

1. Using a more accurate town boundary
2. Street Network Data Layer
3. Text labels (annotation).

Details about the first two of these recommended elements are presented in Level II of this standard where they are required elements. The third and fourth recommended elements above are discussed below, as they are not required for either Level II or III of the standard. If implemented, these recommended elements will facilitate development of a city/town GIS in both the short and long-term.

1. Using a More Accurate Town Boundary

This is a requirement at Level II of the standard. See discussion on page 24 for details on this recommendation.

2. Street Network Data Layer

People orient themselves on assessor's maps based on street names. Therefore, development of a digital parcel file should be accompanied by development of a GIS data layer containing a street line network. By late 2003, MassHighway will have completed migrating their road network to a scale (1:5000) suitable for municipal GIS projects. This will provide communities with a road network that includes a street name attribute. Communities intent on developing a broadly useful GIS database, will find that systematically inventorying their roads to ensure that each one is represented in this road network will be worthwhile. They should also consider adding attributes containing the following information:

- Address ranges for each street segment stored in four separate databases fields (left "from" address, left "to" address, right "from" address, and right "to" address),
- Whether a street segment is one-way
- Whether a street segment is private or public
- Whether a street segment is built or not (i.e., streets may be created as part of a subdivision, but do not exist because the subdivision is not built)

In the above context, a street segment refers to that portion of the street between two intersecting streets, between an intersecting street and where the street crosses the city/town line, or between an intersecting street and a dead-end.

3. Text Labels

Assessor's maps often include other important text-based information. These typically include labels such as lot numbers on parcels, block numbers, lot areas, lot deed area, property dimensions (length), and easement type/purpose (e.g., water/sewer/drain, vehicular access). Using GIS software capabilities for labeling property polygons based on database attributes is the best approach for labeling properties with lot numbers and areas. The importance of other text on assessor's maps will vary depending on the community.

Other text labels that may be needed include parcel boundary dimensions and easement type/purpose. One approach to creating text labels is creating an additional GIS data layer containing points or lines with the attribute needed for creating the desired text labels. So, for example, creating labels showing parcel dimensions would be achieved by creating short line segments just inside and parallel to each property boundary where a dimension needed to appear. Each of these lines would have an attribute containing the dimension of the adjacent property boundary. These dimensions could then be added displayed on a computer screen or a map by symbolizing the line feature as white or "clear", and then labeling it with text from the attribute. This approach means the text labels can be positioned in the desired locations while not displaying the lines or points that make the label positions possible.

Alternatively, if Arc/Info based annotation exists already, it may be possible to use ArcInfo commands to convert the annotation to a data layer containing point or line features with an attribute of the annotation text. This data layer could then be used to produce text labels as described above.

DIGITAL PARCEL FILE STANDARD LEVEL II

Compliance with this level of the standard includes compliance with all of the Level I requirements. In summary, those requirements are:

- Meeting minimum compilation standards and horizontal accuracy requirements,
- Adding minimum parcel file attributes
- Including a minimum set of attributes from the assessor's database,
- Using the North American Datum of 1983 (NAD83), and
- Metadata.

Level II has four additional required elements, one of which was recommended at Level I.

A digital parcel file complying with Level II of this standard will much more effectively support a city or town's GIS project. The additional required elements at Level II are:

1. Each parcel polygon must have additional required attributes.
2. An enhanced link to assessor's data must be developed.
3. The town boundary must be based on the official legislated boundary coordinates recorded with the Massachusetts Highway Departments Survey Section,
4. The file format of the digital parcel file(s) must be in or it must be possible to convert it to ESRI shape file format and, if state funded, the files must be delivered to MassGIS.

These elements are described in more detail below.

ADDITIONAL REQUIRED PARCEL ATTRIBUTES

In addition to the Map_Par_ID required at Level I, required parcel file attributes for Level II are LOC_ID, LOC_ID_UN, INTEREST, and POLY_TYPE. These were presented in the definitions section of this standard and are also discussed below. At the end of this section database rules specific to this standard involving the INTEREST and POLY_TYPE attributes are also presented.

1. Details On Additional Attributes

LOC_ID - This identifier, and its accompanying attribute, LOC_ID_UN, are added at this level to the "Parcel File Attributes". As described in the definitions section, the unique Loc_ID identifier for parcels is created by appending together the X and Y coordinate values of a point that lies within the parcel. The point may be generated in many software systems automatically. It should ideally be at the visual center of the parcel. It may also serve as the center or origin of a text label in those cases where the size of the polygon and the desired size of the label text are compatible. The Loc_ID will provide a unique statewide identifier for parcels.

Note that Loc_ID values based on creating a centroid for each parcel can result in incorrect Loc_IDs. Incorrect Loc_IDs can result from the following:

- If the centroid is based on the "geographic center" (VS visual center) of the polygon, software may end up placing the centroid outside the polygon if the polygon has an unusual shape (e.g., an "L" shaped parcel)
- If a parcel is very narrow, when the numbers after the decimal are dropped to create the Loc_ID, the resulting shift in the coordinate location may end up representing a point

outside the polygon. In these cases, manual editing of the Loc_ID value may be needed to obtain a coordinate value that truly exists inside its parent polygon.

LOC_ID_UN – The attribute containing the code for the units ("F" for feet and "M" for meters) of the coordinates from which the LOC_ID was constructed.

INTEREST - The purpose of this attribute is identifying different encumbances or rights in land that may be tracked on the assessor's maps. This is necessary, because some rights (e.g, development rights) may be owned separately from other rights in the land AND the assessor's maps may depict those rights. Only those rights depicted on an assessor's maps are relevant in complying with this standard. Valid values are "FEE" (fee ownership), "PUB ROW" (public road right-of-way, including state highways and interstates), RAIL ROW = railroad right-of-way, "PRIV ROW" (private road right-of-way), "EASE", (easement), "CONDO" (condominium), "CR" (conservation restriction), "APR" (agricultural restriction). Typically it is only map polygons where the INTEREST is "FEE" that should link to an assessing record[1].

POLY_TYPE - Attribute to explain polygons in the file that are not legal interests (character field; valid values are TRAFFIC ISLE = traffic islands in street right-of-way, WATER = ponds/rivers, ISLE = island in pond or river, and OTHER).

Between them, the POLY_TYPE and INTEREST fields are used to explain every polygon on the assessor's maps. This ensures that any polygon on the map, when queried by a user of the data, will return enough information that the user will know something about what that polygon represents.

2. Database Rules for Additional Attributes

The INTEREST and POLY_TYPE attributes are created for complying with Level II of this standard. Most polygons on the map will have an INTEREST value of "FEE". Polygons not classified as representing "FEE" interest will be identified as one of the other valid values for the INTEREST attribute. If the INTEREST attributes is blank, the polygon will be explained by the value for the POLY_TYPE attribute. **The following rules apply to entries in these two fields:**

- If the MAP_PAR_ID attribute has an entry, then the INTEREST attribute must also have a valid entry, unless the POLY_TYPE attribute value is "traffic isle" or "other". (Note - if you have a "dummy" Map_Par_ID, then it will count in the assessment of match percentage, unless it has the exception noted).

- If the MAP_PAR_ID attribute value is empty, then the Poly_type field must be filled unless INTEREST attribute values are "PUB ROW", PRIV ROW", or RAIL ROW".

- If POLY_TYPE is empty then both the MAP_PAR_ID and the INTEREST attributes must both have valid values unless INTEREST attribute values are "PUB ROW", "PRIV ROW", or "RAIL ROW".

When the MAP_PAR_ID attribute has an entry and the POLY_TYPE attribute value is "other", the record will be counted in percent match calculation, regardless of whether or not the polygon is tracked in the assessor's database.

[1] Some assessor's database may include records for map polygons that would not have an INTEREST field value of "FEE".

INTERSECTION TABLE

The intersection table is simply a means of completely specifying all possible linkages between assessor's property records and mapped parcels in order to deal with the data mismatches described below. Accessing information in the assessor's database is among the most important requirements for a city/town GIS. Typically, as described under Level I, the assessor's listing for a single property parcel can be joined in a GIS to the corresponding parcel on the map using the assessor's property identifier (e.g., map/block/lot; section/block/lot, etc.) or a new identifier constructed from similar data elements. However, there is not always a one-to-one correlation between the polygons on the assessor's map and the records in the assessor's database. For example, the following situations occur:

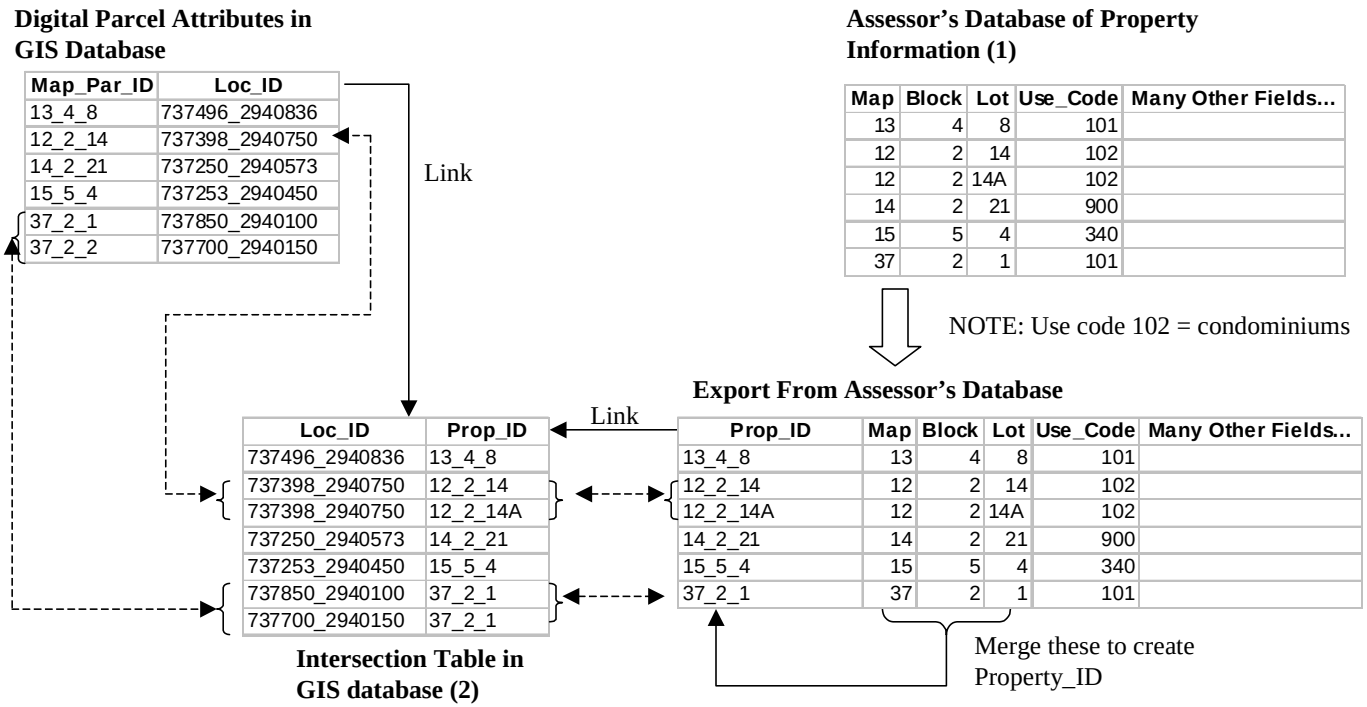
a. Two (or more) polygons on the assessor's map may be assigned the same MAP_PAR_ID or equivalent and linked to just one record in the assessor's database (commonly indicated on maps with "fish-hook" symbols linking the parcel polygons involved.) For example, a small river may run through a single property splitting it into two separate separate polygons. By assigning a unique Loc_ID to each polygon and developing an additional database table, the "intersection table" (discussed below), this situation can be corrected.
b. Several polygons with different MAP_PAR_IDs may have only one corresponding record in the listing, often because the assessor wishes to issue just one assessor's tax bill per owner. In this instance there are parcel identifiers on the map that may not match any records in the assessor's database.
c. Individual units in a condominium complex will each have a record in the assessor's database, but the property identifier associated with each condominium usually cannot be linked to a parcel of land on the property map. Also, note that the common property (land and exterior of structures) of a condominium association may or may not be separately listed as a "master record" for a condominium.

Digital parcel maps complying with level II of the standard will achieve a higher, and sometimes much higher, match between parcels shown on assessor's maps and corresponding listings in the assessor's database. This will be particularly true in communities with many condominiums or with frequent occurrences of multiple parcels covered by a single assessor's tax bill.

Complying with this level of the standard involves creating an intermediate database table (the "intersection" table) containing two fields, one for the Loc_ID and one for the Prop_ID. The Loc_ID field must be generated and included in the digital parcel mapping attributes and in the intersection table. The Prop_ID field must be generated and included in the extract or report from the assessor's database as a unique identifier for each property and in the intersection table. Any one record in the intersection table matches only one parcel-to-one assessor's record and vice-versa. Conversely, because the intersection table is an independent table, it makes possible the matching of multiple parcels to one assessor's record (case "b" above) or of multiple assessor's records to one parcel (case "c" above.) **The role of the intersection table is best understood by studying Figure 1.**

One approach to creating the intersection table is to create the table and then to put all the Prop_IDs into that table. Then join the intersection table TO the parcel attributes on the Map_Par_ID. Where there is a match between the two tables, the Loc_ID in the parcel attribute table can then be copied into the corresponding filed in the intersection table. This then leaves records in the intersection table with null Loc_ID values; most of these will be condominium records or map polygons for which there is no corresponding assessor's record. Alternative strategies will be needed to fill the emply Loc_ID fields in the table.

Figure 1: Role of Intersection Table in Linking Parcels and Assessor's Database



(1) Field names other than map, block, lot may be used, depending on the community.

(2) The intersection table makes it possible to associate the two condo units with the same polygon on the map (property identified as 12_2_14). Similarly, the two separate map polygons identified as 37_2_1 and 37_2_2 are represented in the intersection table by their unique Loc Ids.

While the approach described above may initially seem complex, it is based on standard database design principles and is not overly burdensome to implement, particularly given the long-term benefits. At a time when more and more local governments are creating GIS databases, this approach creates a sound and versatile foundation for supporting further GIS and other computer based capabilities. The key steps required for implementation are, in the intersection table, assigning:

a) A Loc_ID to records in the assessor's database that do not match to a property on the assessor's maps (e.g. condominiums), and
b) A Prop_ID from the assessor's database to properties from the assessor's maps that do not match a property listing in the assessor's database.

ADDITIONAL PARCEL FILE DELIVERY OPTIONS

If other legal interests are depicted on the assessor's maps (e.g., easements, conservation restrictions, or agricultural preservation restrictions), one alternative to including these polygons directly in the polygon file of assessor's parcel boundaries is to deliver them as separate data layers in their own files. In other words, instead of including easements or conservation restriction boundaries in the assessor's parcel file, these boundaries would each be in a separate GIS data layer. In this case, the parcel attributes of these additional files would simply be the MAP_PAR_ID, LOC_ID and LOC_ID_UN. No POLY_TYPE or INTEREST parcel attributes would be required (or relevant). Note that the MAP_PAR_ID would contain whatever identifier is used for referring to the CR, easement, or APR. If this approach is taken, an intersection table that ties each polygon to one or more assessor's records must also be created; this table would have the same two fields (Loc_Id, Prop_ID) as that for the "fee simple" polygons on the assessor's maps, but the Loc_IDs would be for the CR or APR polygons and the Prop_IDs would be for those assessor's records that cover some portion of the CR or APR.

MassGIS entire database is now in an ESRI ArcSDE/Oracle database. As MassGIS begins construction of the statewide digital parcel data layer, it too will be a data layer in this same database. Therefore, anyone interested in delivering digital parcel files to MassGIS in ESRI geodatabase format should contact MassGIS. Until MassGIS staff develops a design for digital parcel files in the geodatabase environment, deliveries in this format will likely only work if contact with MassGIS is made prior to building the geodatabase.

Whether the digital parcels are developed as a single GIS data layer, as several data layers representing different land rights, or as a geodatabase, the boundaries represented in these files must, of course, still meet all the Level I requirements for boundary compilation.

TOWN BOUNDARY

If the boundary between adjacent cities or towns agrees in the digital parcel file from each community, then it will be much easier to use digital parcel information jointly or in regional GIS applications. Digital parcel files complying with Level II of this standard must include a town boundary based on the legislated record of each town's boundary. These legislated records are found in Massachusetts General Laws and include surveyed coordinates for each boundary marker. The Survey Section at the Massachusetts Highway Department (MassHighway) keeps an up-to-date record of these coordinates. The corner points, witness marks and accompanying

maps in the Survey Department's records[2], as well as legislated changes, have been entered to a database. MassGIS is working to produce a vector (line) version of town boundaries based on these legal boundary coordinates. Contact MassGIS with questions concerning the availability of the coordinates or their vector representation for a town's legal boundary. A new boundary for most cities and towns will be available through MassGIS by late 2003 or early 2004. This new town boundary includes a new more detailed coastline at 1:5000 scale. Either the coordinates or, if created, the vector boundary must be used when complying with Level II of the standard. The final digital parcel must include the new town boundary incorporated directly into the digital parcel file. All property boundaries must cease at the town boundary. The boundary must also close off all street rights-of-way at the edge of the community. One effect of this is that the road rights-of-way will become polygons; these must then be classified as "PUB ROW" or "PRIV ROW" in the "Interest" attribute field.

Note that property boundaries should be adjusted to the new 1: 5000 coastline unless an existing digital, larger-scale, coastline is preferred. Because developing a town boundary for the digital parcel file based on the statutory boundary may involve resolving significant property boundary discrepancies, use of the statutory city/town boundary requirement is subject to waiver if appealed to MassGIS. A waiver of this requirement may be granted if the statutorily correct boundary causes properties to move from one town to another. A waiver may also be granted if, in the judgement of the Director of MassGIS there are other circumstances that would make this requirement exceptionally burdensome for a community to implement.

FILE FORMAT

A widely used published format that can be read by many different mapping software packages is ESRI's "shape file" format. This format actually results in several files with the same root name and various file type suffixes. Other possible file formats include those for GIS software from Autodesk (AutoCAD Map), Mapinfo Corporation, Caliper Corporation (Maptitude), Intergraph Corporation (GeoMedia, MGE), and others. While it is not the intent of this standard to require the use of any particular software, the ESRI shape file format represents a de facto standard in Massachusetts. It is also a published or "open" format that commonly used GIS software can both import from and export to. Since this level of the standard requires that a copy of the digital data files be submitted to MassGIS, in complying with Level II of this standard, it must be possible to provide the parcel boundary features as a file in either ESRI's ArcView (shape file) or ArcInfo export file formats. The intersection table and the copy of the assessing data required at this level of the standard may be delivered as dBase files or in a Microsoft Access database file. This element of the standard does not preclude using some other software to create and maintain the digital parcel file. As MassGIS does work with the shape file format and also, more recently, with and ArcSDE/Oracle database, anyone interested in delivering digital parcel files in geodatabase format should contact MassGIS; deliveries in this format will likely only work if that contact is made prior to building the geodatabase.

RECOMMENDED LOC_ID ARCHIVE

Level II creates a unique identifier for parcel map polygons by requiring development of a LOC_ID. As parcel boundaries change because of subdivision or combination, it may be useful to archive LOC_IDs that disappear because of these processes. So, for example, if a four-acre

[2] The Harbor and Lands Commission Town Boundaries Survey, circa 1900

property is subdivided into four one-acre parcels, its present LOC_ID will disappear, to be replaced by four new LOC_IDs. Conversely, if two parcels are combined into one, one of the existing LOC_IDs will disappear. An alternative to simply deleting these LOC_IDs would be to archive them. This archive table would contain the following fields:

NEW_LOC_ID = the LOC_ID of the property or properties formerly represented by the OLD_LOC_ID
OLD_LOC_ID = the LOC_ID that has been eliminated
DATE = date when the update occurred (Use YYYYMMDD format)

So, in the above example of the four-acre property that was subdivided, the archive table would contain four NEW_LOC_ID entries, one for each of the four new one-acre properties. Each of these would have the same entry in the OLD_LOC_ID and DATE fields.

For the case where two parcels were combined to one, the same NEW_LOC_ID would be entered twice, once each for each of the LOC_IDs that was deleted and entered as the OLD_LOC_ID. This second case presumes that one of the two existing LOC_IDs would be retained for the combined parcel. If both original LOC_IDs were deleted and replaced with a new LOC_ID, then the new LOC_ID would be entered to the NEW_LOC_ID field twice, once for each of the original LOC_IDs entered to the OLD_LOC_ID field.

DIGITAL PARCEL FILE STANDARD LEVEL III

Complying with this level of the standard includes compliance with all of the Level II requirements. Compliance with Level III is strongly recommended for communities building GIS databases. While the work required to achieve compliance is not trivial, it will provide significant benefits to the community's GIS and other computer related capabilities. Compliance will also be required as a condition for obtaining higher levels of state funding for GIS data development, should they be available.

Complying with this level of the standard has three parts:

1. Fully integrating the Loc_ID into the Assessor's database.
2. Developing a Master Address File
3. Optionally, uniquely identifying buildings and associating them with addresses.

INTEGRATE LOC_ID INTO ASSESSOR'S DATABASE

A copy of information from the assessor's database, or even a direct link to the assessor's database can most easily be accomplished if two steps are taken:

1. The intersection table described at Level II of the standard is eliminated and the Loc_ID is incorporated directly into the assessor's database,
2. Additional records are added to the assessor's database to account for situations where there is one tax record but two (usually not more) ownership interests (polygons) on the map.

In essence, these two steps require fixing all the problems identified in achieving compliance with Level II, by ensuring that every record in the assessor's listing includes a reference to one and only one ownership interest (map polygon) in the digital parcel file. Information from the Assessor's database would still be provided to the digital parcel file by making a copy of that information and attaching it to the parcel file. However, since the Loc_ID field would be directly incorporated into the assessor's database, the intersection table would no longer be necessary.

MASTER ADDRESS FILE

Street addresses are the most common method in local government for identifying a location. Addresses are used for everything from reporting crimes and responding to emergencies, to identifying locations of repairs made by Public Works Department employees, to locating business licensees, inspections, and students. In short, addresses are used for accessing and indexing about 75% of all municipal information. GIS software typically has the capability for finding a location using an address. Because local government functions rely so heavily on street addresses, it is important that high address match rates be possible using the GIS software. However, achieving high match rates requires an accurate and complete listing of all addresses, and that each address can be linked to a known location. This location can be interpolated from address ranges associated with street line segments (this is the basis of most "address matching") or it can be more accurately referenced to either a parcel or a building footprint. While addresses associated with a street network may be developed more quickly (in many areas they are available from government or commercial sources), they do not enable GIS software to identify an address location as accurately as those associated with a parcel or a building - and for emergency response or public safety purposes such errors can be costly or even fatal.

However, the following may complicate compiling address information for properties:

1. One parcel may have several building entrances with different house numbers for each entrance, or one building with several units having frontage on different streets (e.g., a two family house on a corner lot)
2. Non-standard addresses or additional notes about location ("rear entrance") may be entered into the address field.
3. Specific identifying information for condominium or apartment units such as unit number may be listed in with the building address.

Therefore, the best solution for communities in the long-term is developing a master address file (MAF). A MAF provides the community with a single authoritative source for all addresses in their community. Typically, the MAF is not something developed overnight, but rather incrementally, as missing addresses are discovered and as problem addresses are corrected. Developing and sustaining a MAF requires both a financial and institutional commitment. The need for the financial commitment is obvious as developing a MAF will cost money, at least in terms of staff time, but perhaps also for software development or purchase. The institutional requirement involves municipal departments committing to new procedures that ensure the content of the MAF is correctly maintained. The MAF includes the Loc_ID for the parcel within which the building with that address is located and the following standard address elements (complete field definitions are in Appendix A):

a) LOC_ID = Unique identifier for the assessor's parcel where the address is found.
b) BUILD_ID = Unique identifier for the building where the address is found.
c) NUM = House number (numeric field, no characters).
d) NUM_SFX = Alpha suffix to the house number, if it exists (character field)
e) PFX_DIR = Cardinal direction prefix to street name (one of the following single characters: *S,N,E,W*)
f) STREET = Street name (in full, as in *Commonwealth*, NOT *Comm.*; character field, use local name rather than numbered highway designation which should be listed as alternate name described below); this should not be the development name ("The Gables", "Pine Meadows")
g) ST_SFX = Street suffix type (character field, using standard abbreviation such as *ST, AVE, RD* – this standard uses the U.S. Postal Service abbreviations in Publication 28 (see (http://pe.usps.gov/cpim/ftp/pubs/Pub28/pub28.pdf) do not use punctuation (e.g., RD not RD.)
h) SFX_DIR = Cardinal direction suffix (character field)
i) UNIT = Unit identifier or secondary building identifier (such as "rear", "basement"; character field)
j) CITY = City/Town name as typically recorded by the Assessor (character field)
k) ZIP = Zip code (this must be character field because of the leading zero in Massachusetts zip codes and it must be large enough to accommodate zip+4)
l) ALIAS_ST1 = full alias street name (e.g., Route 1, VFW Parkway, different spelling, or an alternate name)
m) ALIAS_ST2 = full second alias street name, if needed.

In most communities, the assessor's database can provide a good start for creating the master address file. This is true because the information collected for each property by the assessor typically includes the site address. Even more importantly, the assessor's database, through the Prop_ID, provides a means of associating this address with a location – the parcel on the

assessor's map. Additional addresses that may be associated with a parcel (e.g. additional numbers for multiple buildings on the same parcel, or building frontage on two streets) should be included in the master address file. This is done using the Loc_ID to link each address back to the appropriate parcel.

This database structure for maintaining address information allows for a proper and unambiguous linkage among the parcel mapping, the assessor's database, and a community's master address file. Note that a key part of implementing a MAF is developing a procedure for keeping it up-to-date as properties are developed or re-developed.

UNIQUE BUILDING IDENTIFIER

Finally, in an ideal implementation of GIS at the local level, communities may choose to associate addresses with buildings instead of parcels. This requires the creation and maintenance of one additional unique identifier, the "Building_ID" (BUILD_ID). This identifier is similar in concept to the Loc_ID for parcels, which is used to uniquely identify the polygon of the building footprint. The BUILD_ID would be created in the same manner as the LOC_ID. The BUILD_ID identifier would then be included in the MAF, thus linking addresses to buildings.

APPENDIX A: ATTRIBUTE FIELD DEFINITIONS

(Use either dBase **OR** Microsoft Access Definitions)

	DBASE FILE DEFINITION			MS ACCESS DEFINITION					
Field Name	**Type**	**Size**	**Dec. Places**	**Type**	**Size**	**Valid Values**	**Level I**	**Level II**	**Level III**
Parcel File Attributes									
MAP_PAR_ID	C	18		N/A	N/A		REQ	REQ	REQ
LOC_ID	C	15		N/A	N/A		N/A	REQ	REQ
LOC_ID_UN	C	1		N/A	N/A	F (feet), M (meters)	N/A	REQ	REQ
POLY_TYPE	C	18		N/A	N/A	TRAFFIC ISLE, WATER, ISLE, OTHER	N/A	REQ	REQ
INTEREST	C	12		N/A	N/A	FEE, PUB ROW, PRIV ROW, RAIL ROW, EASE, CONDO, CR, APR	N/A	REQ	REQ
Intersection Table									
LOC_ID	C	15		C	15		N/A	REQ	N/A
PROP_ID	C	18		C	18		N/A	REQ	N/A
Attributes from Assessor									
PROP_ID	C	18		C	18		REQ	REQ	REQ
TOTAL_VAL	N	9		N	Long Integer		REQ	REQ	REQ
FY	C	10		C	10		REQ	REQ	REQ
LOT_SIZE	N	11	2	N	Double		REQ	REQ	REQ
LOT_UNITS	C	1		C	1	S (sq. ft.) **OR** A (acres)	REQ	REQ	REQ
LS_DATE	C	10		C	10		REQ	REQ	REQ
LS_PRICE	N	9		N	Long Integer		REQ	REQ	REQ
LAND_USE	N	6		N	Long Integer	Set by Dept. of Revenue	REQ	REQ	REQ
LO_NUM	N	5		N	Long Integer		REQ	REQ	REQ
HI_NUM	N	5		N	Long Integer		REQ	REQ	REQ

(Continued on nex page)

(REQ = Required; rec = Recommended)

	DBASE FILE DEFINITION			MS ACCESS DEFINITION					
Field Name	**Type**	**Size**	**Dec. Places**	**Type**	**Size**	**Valid Values**	**Level I**	**Level II**	**Level III**
SITE_ADDR	C	50		C	50		REQ	REQ	REQ
CITY	C	24		C	24		REQ	REQ	REQ
ZIP	C	10		C	10		REQ	REQ	REQ
OWNER1	C	60		C	60		REQ	REQ	REQ
OWN_ADDR	C	60		C	60		REQ	REQ	REQ
OWN_CITY	C	24		C	24		REQ	REQ	REQ
OWN_STATE	C	2		C	2		REQ	REQ	REQ
OWN_ZIP	C	10		C	10		REQ	REQ	REQ
OWN_CO	C	18		C	18		REQ	REQ	REQ
LS_BOOK	C	8		C	8		REQ	REQ	REQ
LS_PAGE	C	6		C	6		REQ	REQ	REQ
LIV_UNITS	N	4		N	Long Integer		REQ	REQ	REQ
BLD_AREA	N	9		N	Long Integer		REQ(2)	REQ(2)	REQ(2)
Optional Parcel File Attributes									
ZONING	C	8		C	8		rec	rec	rec
MAP_NO	C	4		C	4		rec	rec	rec
SOURCE	C	12		C	12	ASSESS MAP, SUBDIV, ANR, ROAD PLAN, OTHER	rec	rec	rec
PLAN_ID	C	12		C	12		rec	rec	rec
UPD_DATE	C	6		C	6	formatted as YYYYMM	rec	rec	rec
RES_AREA	N	6		N	Long Integer		rec	rec	rec
CI_AREA	N	9		N	Long Integer		rec	rec	rec

(Continued on nex page)

(REQ = Required; rec = Recommended)

	DBASE FILE DEFINITION			MS ACCESS DEFINITION					
Field Name	**Type**	**Size**	**Dec. Places**	**Type**	**Size**	**Valid Values**	**Level I**	**Level II**	**Level III**
Master Address File									
BUILD_ID	C	15		C	15		N/A	N/A	rec
LOC_ID	C	15		C	15		N/A	REQ	REQ
NUM	N	6		N	Long Integer		rec	rec	REQ
NUM_SFX	C	4		C	4		rec	rec	REQ
PFX_DIR	C	1		C	1	S,N,E,W	rec	rec	REQ
STREET	C	24		C	24		rec	rec	REQ
ST_SFX	C	4		C	4		rec	rec	REQ
SFX_DIR	C	1		C	1	S,N,E,W	rec	rec	REQ
UNIT	C	12		C	12		rec	rec	REQ
CITY	C	24		C	24		rec	rec	REQ
ZIP	C	10		C	10		rec	rec	REQ

APPENDIX B: CHANGES FROM VERSION 1.0

Version 1.0 was released July 2001. **The page numbers below refer to those in Version 1.0 of the Standard.**

NOTE: A complete summary of the changes to the attributes and database fields is below under the discussion of changes to Appendix A.

Table 1 (p. 5)

This table has be re-arranged to match the order in which items are discussed in the text and page numbers keyed to the relevant section of the text have been added. Similarly, the names of the elements in the standard listed in the table have been changed to match the section headers in the text

"Data layers to support text labels" – recommended, NOT required at all levels of the standard.

Parcel Attribute Definitions (p. 6)

Loc_ID –Specified that the X and Y coordinate components must NOT include any places after the decimal and that units can be U.S. Survey Feet OR meters. An additional attribute (LOC_ID_UN) has been added to track the units of the Loc_Id.

Definitions for the attributes INTEREST and POLY_TYPE have been added and other definitions have been clarified or expanded

The POLY_TYPE field previously included a possible value of "RAIL ROW"; this value is no longer valid for POLY_TYPE but is now a valid value for the INTEREST field.

Valid values of INTEREST have been expanded to include "RAIL ROW" (previously a valid value for POLY_TYPE attribute) and "CONDO". The value CONDO has been included because it is helpful in identifying land with condominiums without referring to the assessing attributes; also an approach to inserting records for condominiums into the intersection table could involve initially identifying polygons with condominiums. Regardless, this value can readily be added based on a join to the assessor's table where the LAND_USE attribute value of "102" identifies condominiums.

The valid value for the INTEREST attribute of "MUNI ROW" has been changed to "PUB ROW" (for public right-of-way).

At Levels II and III, added recommendation to archive LOC_IDs made obsolete by parcel subdivision or combination.

Requirements for Boundary File Compilation (p. 9)

The beginning part of this discussion of requirements has been edited to reflect that the INTEREST attribute is no longer a Level I requirement. The alternative parcel file

delivery option originally discussed here has become part of an expanded section on data layer deliver options in Level II.

Required Map Identifier (p. 10)

This sub-section is now called "Additional Parcel File Attribute". At Level I the only required parcel attribute is the Map_Par_ID. The requirement for the INTEREST and POLY_TYPE fields has been moved to Level II. See the discussion below of what happened to the sub-heading "Unique Statewide Identifier".

Attributes from Assessor's Records (p. 11)

The copy of data from the Assessor's database may now be delivered either as a dBase file or in a Microsoft Access database.

The POLY_TYPE and INTEREST fields were previously mistakenly included in this discussion. The discussion of these attributes is in a new section in Level II called Additional Parcel File Attributes. A comparable section now also exists in the Level I standard and presents the MAP_PAR_ID.

The discussion in this section has been edited and expanded. The LAND_VAL and BLDG_VAL attributes from the assessor's records have been combined into the TOTAL_VAL attribute. This matches a recent shift in the Department of Revenue's requirements.

The required attributes from assessor's records at Levels I and II now include LO_NUM, HI_NUM, SITE_ADDRESS, SITE_CITY, and SITE_ZIP. LO_NUM and HI_NUM are for house numbers, with LO_NUM being the lowest number found in a site address and HI_NUM the highest. Obviously the HI_NUM attribute is only filled if the site is occupied by a multi-family dwelling.

Metadata (p.13)

The option for using the MassGIS metadata standard has been dropped. Metadata must now be created in accordance with the Federal Geographic Data Committee (FGDC) standard.

Recommended Elements (p.13)

Since some of these elements became required at Level II, the discussion for thos elements has been moved to that section of the standard; discussion of the elements that remain recommended throughout remains in this location. In Version 1.0 of the Standard, creating a street network with a street name attribute was required at Level II. That is now recommended, but with the addition of attributes storing street addresss ranges and some other attributes useful for a city or town GIS.

Discussion of Town Boundary (p.14, 20)

As indicated above, the discussion of this requirement has been moved to the Level II section. In addition it has been updated and now includes discussion of compilation issues at the coastline and streams. It was the intention in Version 1.0 of the Standard that the new town boundary be incorporated directly into the digital parcel file so that it closed all street rights-of-way at the community's border. The discussion of this intent has been made more explicit. Also new is that property boundaries must be clipped by the town boundary.

Street Names (p. 15)

The requirement for developing a street line network with street names has been changed from required or recommended to recommended at all levels. Orginally this requirement was included in the standard to ensure that communities conforming to the standard also acquired a means for depicting street names with their digital files. This requirement has been dropped because MassHighway is developing a suitable road network with the requisite street name label. Based on the 1:5000 scale road network available through MassGIS and already used by many communities, this new MassHighway road network was made available through MassGIS for most of the state in late 2003. The entire state will be available by early 2004. Since the MassHighway road network includes street names, and because of its' new spatial accuracy, the MassHighway data will meet the needs of municipal government in this context.

Unique Statewide Identifier (p. 17)

The name of this section has been changed to "Additional Required Parcel Attributes" and now includes the LOC_ID, LOC_ID_UN (a new attribute), INTEREST, and POLY_TYPE fields.

At Level II of the standard a new attribute, LOC_ID_UN, has been added to these standard attributes.

The discussion of both the INTEREST and POLY_TYPE fields has been edited. In addition, **database rules concerning the interaction between the MAP_PAR_ID, INTEREST, and POLY_TYPE attributes have been added.**

Figure 1 (p. 19)

A typo that makes this figure more difficult to understand has been corrected. In the table "Digital Parcel Attributes in GIS Database" in the upper left of the figure, the Map_Par_ID entered in the last row has been corrected to be 37_2_2 instead of the incorrect 37_2_1.

Site Address (p. 20)

This refers to breaking the site address into its constituent parts (e.g., house number, street name prefix, street name, name suffix, etc.). This was among the recommended elements at Level I and is no longer; it has been replaced by a requirement for additional

assessing attributes of LO_NUM, HI_NUM, SITE_ADDR, SITE_CITY, SITE_ZIP. The address broken into constituent parts is now recommended at Level II and required at Level III as part of creating a master address file.

Level III Discussion (p. 22)

The concept of associating addresses with buildings has been broken out as a separate section and an optional addition to the Parcel File Attributes called a BUILD_ID has been created.

Appendix A (p. 24)

This table has been re-arranged so that the different field names are listed according to the database table in which they must appear. Also, columns have been added for each level of the standard identifying whether the field is recommended or required.

Database definitions for the following parcel attributes have been added:

MAP_PAR_ID
LOC_ID
LOC_ID_UN (new field)
BUILD_ID

Domain values have changed for:

INTEREST – Now includes “RAIL ROW” and “CONDO” and “MUNI ROW” value has been changed to “PUB ROW”.
POLY_TYPE – “RAIL ROW” value has been eliminated.

The following field definitions related to assessing attributes have been modified or added:

PROP_ID definition has been added
TOTAL_VAL replaces LAND_VAL and BUILD_VAL
The size of the field OWNER1 has been increased to accommodate longer entries. Instead of 36 characters, it is now 60.
LOT_SIZE has been increased from 6 with 2 decimal places to 11 with 2 decimal places.
LO_NUM has been added
HI_NUM has been added
SITE_ADDR has been increased to size 50
OWNER1 has been increased to size 60
OWN_ADDR was defined incorrectly and it is now a character field (C) with a size of 60.
LIV_UNITS was defined incorrectly and it has been changed to numeric (N) with size 4; still only has to be populated if information available from assessor
LS_PAGE size has been increased to 6.

At Levels II and III, added recommendation to archive LOC_IDs made obsolete by parcel subdivision or combination.

Quality Assurance Checks

A detailed description of the MassGIS digital parcel file QA procedures is now included in a new Appendix C.

APPENDIX C: MASSGIS QUALITY ASSURANCE CHECKS

MassGIS quality assurance of digital parcel and related files intended to comply with Level II of the standard covers four areas:

1) The attribute names and definitions of parcel file attributes and of assessing data attributes
2) The linking between the parcel attributes and the intersection table, the intersection table and the assessing attributes, and vice versa.
3) The parcel boundary compilation, as it appears on top of the MassGIS/MHD color orthophotos, as it compares to the spatial location of the 1:5000 scale road network, and as it compares to the legislated town boundary.
4) Metadata.

These are each discussed in more detail below. Note that MassGIS has developed ArcView 3 Avenue scripts that peform all of the checking needed for steps one and two, above. These scripts, a customized ArcView project file, and relevant data files can be used by anyone with the ArcView software. Contact MassGIS to obtain the QA files and instructions on their use.

Attribute Checking

1) Are all the required identifier fields (Map_par_id, Loc_id, and Prop_id) present in the correct tables?
2) Are the Map_Par_ID, Loc_Id, and Prop_ID constructed correctly (components separated by an underscore character ("_")?
3) Do all the attribute fields as required by the MassGIS Level II Standard exist in the appropriate tables?
4) Do all of the required attribute fields have the correct field type, field width, and precision?
5) Do all records in the assessor's table have values of either "A" (for acres) or "S" (for sq. ft.) for the Lot_units field?
6) Do all records have values in the Poly_type field that exist in the specified domain of acceptable values?
7) Do all records have values in the Interest field that exist in the specified domain of acceptable values?
8) Do all records with a Map_par_id value also have a value in the Interest field?
9) Do all records with a null Map_par_id value have a value in the Poly_type field?
10) Do all records with a null Poly_type value have a value in BOTH the Map_par_id field and the Interest field?

To fully understand numbers 8 – 9 in the above list, see discussion of database rules in Level II of the standard.

Linking Integrity Check

1) Does the match rate between the parcel attributes and the intersection table based upon Loc_id meet the requirement of the 2002 grant awards (99% for towns with more than 1000 parcels, 98% for towns with less?
2) Do all values of Loc_id in the intersection table appear in the parcel attribute table as well?
3) Does the match rate between the assessor's database and the intersection table based upon Prop_id meet the Standard requirement (99% for towns with more than 1000 parcels, 98% for towns with less?
4) Do all values of Prop_id in the intersection table appear in the assessor's table as well?
5) Are all records in the intersection table composed of unique pairs of Loc_id and Prop_id?

Check for multiple polygons associated with a single assessor record where the polygons do not share a boundary AND the polygons do not involve condominiums (passes QA if either 1) or 1a) below is answered YES).

1) Do all non-condominium parcels with a single Prop_id value but multiple Loc_id values exist adjacent to one another or only have a single structure?
1a.) If previous answer was 'NO', does a visual check or assessor's database research verify that the properties in question legitimately belong to the same owner (same prop_id for all parcels), even though they are separate? The most common instance of this is all town-owned parcels being assigned to a single assessor's record; in MassGIS' view this is a practice that should be abandoned, but recognizes that it exists in some communities and so must be accommodated.

Also, situations where two polygons separated by a road right-of-way are associated with a single assessor's record are NOT flagged in the QA process. This is because it is assumed that the road split what had previously been a single polygon owned by one entity into two.

Boundary Compilation Check

General Accuracy (Review of linework, polygons, and boundary compilation quality as observed through visual inspection relative to the color orthophoto base map).

Property boundary compilation is reviewed relative to the requirements and limitations described in Level I. Boundaries in urban areas are expected to more closely conform to visible features on the base map than those in more rural areas. Where there are sidewalks, it is expected that road rights-of-way will coincide with the back-of-the-sidewalk, particularly in "down town" areas or where newer subdivisions exist and there is high contrast between paved areas and vegetated areas. Within the limitations described under Level I, consistent widths for rights-of-way are expected everywhere. Where widths are uneven or where right-of-way boundaries stray deep into property front yards or other areas that on the base map are unlikely to be part of the right-of-way, boundary compilations will be questioned. This will be particularly the case with

numbered routes and in areas where base map features (pavement, stone walls, hedges, and tree lines) suggest boundary alignments that are consistently not observed in the boundary compilation. Other than ROW widths, greater inconsistency between compiled boundaries and the basemap will be expected in more rural areas, particularly along lakes/ponds or the ocean. While not an absolute indicator of boundary compilation problems, situations where the 1:5000 scale road lines do not fall into the road right-of-way will always be scrutinized closely. MassGIS understands that roads are not always built according to the plans that may be the basis for assessor map updates. If a community is aware of specific situations where the assessor's maps were updated in a way that does not match how a road was actually constructed, they should identify those areas when submitting parcel data to MassGIS for QA. This is probably best done by providing a shape file with point or line features at the relevant locations that include an attribute with a brief explanation of the inconsistency (e.g., "road built differently than plan from which map updated"). Nonetheless, widespread problems with the 1:5000 scale roads not fitting into the ROW depicted on the assessor's maps will draw close scrutiny and a likely failure of the QA process.

Loc_Id Accuracy

Does every parcel have a Loc_id value that translates to coordinates that fall inside the polygon boundary with which it is associated?

Street Datalayer Accuracy

Do the roads exist without any lateral overlaps onto the parcel boundaries that suggest a problem with the horizontal accuracy of the parcels?

Town Boundary Check

Do the Mass. Highway Department town boundary survey points all exist within a five-foot buffer of the vectors in the digital parcel file representing the town boundary?

Medadata Quality

1) Date of data creation listed?
2) Source materials listed and described?
3) Contact Information?
4) Data Characteristics?